Astrophysics Research And Analysis

Multi-Color Anisotropy Measurements of the Cosmic Near-Infrared Extragalactic Background Light with CIBER2

Completed Technology Project (2016 - 2021)

Project Introduction

We propose to carry out a program of observations with the Cosmic Infrared Background Experiment (CIBER-2), a sounding rocket instrument designed to measure anisotropy in the extragalactic background light in multiple optical to near-infrared spectral bands. Scientifically, CIBER-2 follows on the results of CIBER-1, which has detected near-infrared background anisotropy. CIBER-1 has also produced leading results on the absolute brightness of the background, the spectrum of diffuse galactic light, the spectrum of Zodiacal light, and constraints on the Zodiacal light foreground from Fraunhofer line observations. CIBER-2 builds on the measurement techniques developed and successfully demonstrated by CIBER-1. With high-sensitivity, multi-color anisotropy measurements, CIBER-2 will elucidate the history of interhalo light production and carry out a deep search for extragalactic background fluctuations associated with the epoch of reionization. A plausible interpretation of the infrared background anisotropy detected by CIBER-1, Spitzer and AKARI is interhalo light from stars tidally stripped from their parent galaxies during galaxy mergers. Based on the rms amplitude of the anisotropy, interhalo light produces approximately half of the background, representing a major branch of light production. Probing the history of interhalo light through improved anisotropy measurements using multiple bands and correlating with tracers of large-scale structure is essential to understand its role in the cosmic history of star formation. The first generation of stars and their remnants are likely responsible for the reionization of the intergalactic medium, observed to be ionized out to distant quasars at a redshift of 6. The total luminosity produced by first stars is uncertain, but a lower limit can be placed assuming a minimal number of photons to produce and sustain reionization. This 'minimal' extragalactic background component associated with reionization is detectable in fluctuations at the design sensitivity of CIBER-2. The CIBER-2 instrument is optimized for sensitivity to surface brightness in a short sounding rocket flight. The instrument consists of a 28 cm wide-field telescope operating in 6 spectral bands between 0.5 and 2.0 um, cooled to a temperature of 77 K with a liquid-nitrogen-cooled cryostat. Images are composed using 3 focal plane assemblies operating H2RG detector arrays. The instrument is currently being fabricated with international partners and nearing completion. CIBER-2 will extend the CIBER-1 anisotropy meausurements from the near-infrared into the optical, where the EOR and IHL components of the extragalactic background can be cleanly distinguished and separated. We will study the history of IHL production by implementing a multi-band cross-correlation analysis, and use this information to carry out a deep search for an EOR component. We plan joint observations with weak lensing maps, with an optimized set of filter bands to measure spectral cross-correlations, to fully elucidate the history of IHL light production. In addition, our international partners will measure the absolute brightness of the background at optical to near-infrared wavelengths using 3 specialized linear-variable filter spectrometers.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

Multi-Color Anisotropy Measurements of the Cosmic Near-Infrared Extragalactic Background Light with CIBER2

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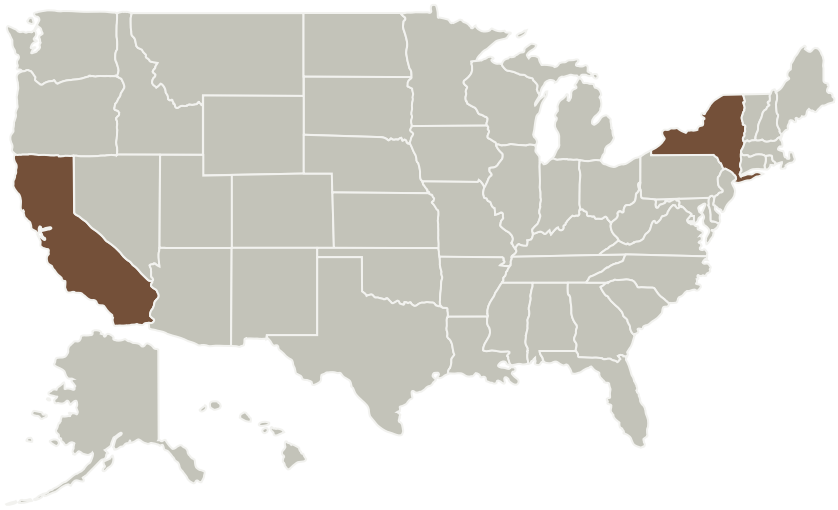
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California

Primary U.S. Work Locations	
California	New York

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

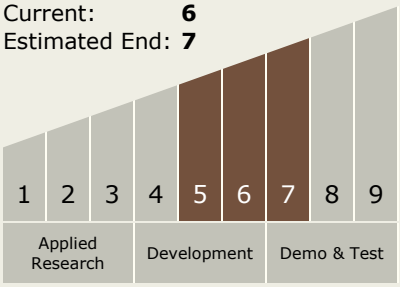
James J Bock

Co-Investigators:

Asantha Cooray
Toshio Matsumoto
Michael B Zemcov
Daehee Lee
Shuji Matsuura
Lucy A Viramontes
Phil Korngut

Technology Maturity (TRL)

Start: **5**
Current: **6**
Estimated End: **7**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors

Continued on following page.

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Completed Technology Project (2016 - 2021)

Technology Areas *(cont.)*

- TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System